

- Industry Proven
- Classic Hardware
- ISP for all Windows Platforms
- Application Builder
- AVR Studio 3 and AVRStudio4 included
- AVREdit and AVRGCC included
- JTAGAVR ICE with adapters



# STK200ICE

## A complete Starter Kit for AVR microcontrollers with JTAGAVR ICE



### The best starter kit ever

The STK200 supplied by Kanda to Atmel was the most successful starter kit EVER produced, with over 30,000 sold worldwide. Its success was due to Kanda's design concept that it should support as many features as possible but remain really easy to use, coupled with our excellent quality control and reliability in manufacture. We are pleased to be able to tell you that a new and enhanced version is now available direct from us.

### STK200 ICE

Now redesigned with the same easy to use philosophy to include new device support and extra features. However, we have made sure that it is compatible with previous versions so your older code or training material will still work. Includes JTAGAVR ICE with adapters to plug straight in. The JTAGAVR is described from page 5 onwards. Note: JTAGAVR ICE only works with AVRs with JTAG Interface - see page 6. Supplied with ATmega162L.

### STK200 board

You need hardware that supports all your needs but does not take weeks to understand. The classic target board is effectively laid out to give you access to all the peripherals of the different AVR devices.

Unlike other starter kits, the STK200 is simple to use and does not require a box full of leads and jumpers. Nor do you have to spend hours studying the manual before you can do anything.

But you still get all the features you need.



### Contents:

- Target board
- Board Schematics
- AVR ATmega162
- ISP
- JTAGAVR ICE
- Full manual on CD
- Application Builder
- AVR Studio 3
- AVRStudio 4
- AVREdit
- AVRGCC
- Code examples
- AVR datasheets

### Compatible with:

- Win/95/98/ME
- Win 2000/NT4/XP

### Order Code:

**STK200ICE**

**STK200ICEU**

- Sockets for different devices. 1 x 8, 2 x 20, 1 x 28 and 2 x 40 pin sockets to support all device pin-outs

- Port Headers. 0.1" (2.54mm) DIL headers for all ports, including a Vcc and Ground pin for external circuitry. Features multiple Port B headers to correctly route signals on smaller devices and retain compatibility with original STK200 boards

- 8-way bar LED and 8 Switches. Can be connected to any available port using short 10-way leads (supplied)

- RS232 circuit. Full specification RS232 port with DB9 connector

- Clock/Port Pin select on smaller devices to free extra I/O pin if not programming

## Device Support, ISP and sockets on STK200 board:

- ATtiny12
- ATtiny13
- ATtiny15
- ATtiny22
- ATtiny2313
- ATtiny26

- AT90S1200
- AT90S2313
- AT90S2323
- AT90S2343
- AT90S2333
- AT90S4414
- AT90S4433
- AT90S8515
- AT90S8535

- ATmega48
- ATmega8
- ATmega88
- ATmega8515
- ATmega8535
- ATmega16
- ATmega161
- ATmega162
- ATmega163
- ATmega168
- ATmega32
- ATmega323

ISP Support only - no board support:

- ATmega64
- ATmega169

ISP support only - board support on STK300:

- ATmega103
- ATmega128

## Order Code:

**STK200ICE**

**STK200ICEU**

- LCD Interface connector. 14-way connector for Hitachi LCD units, complete with contrast resistors and pulse stretching circuitry
- 3.3V or 5V operation. Voltage selection using a single jumper
- Brownout. Built in brownout circuit, with single jumper to set 2.9V or 4.5V level
- ADC circuit. Flexible ADC interface with reference pot or user supplied or internal reference. Supports new ADC features of ATmega devices including differential inputs.
- External Memory. 74HC573 address latch and Flash RAM sockets (Devices available separately)
- EEPROM socket. 24C (2 wire) memory socket
- Clock circuit. External clock circuit for reliable operation on all sockets. Default crystal is 8MHz for Low Voltage devices but board supports crystals up to 16MHz.

### ISP

The system uses a parallel port programmer with 10-way ribbon cable using Kanda standard connection as adopted by Atmel and the ISP software is now an industry standard. This is a full featured programmer with all programming operations - Erase, Read, Program, Verify, including all Fuse and Lockbit settings. For a full description of the programmer, see NAVRISP

### Application Builder

The Application Builder uses simple wizards to create all your setup code including ports, timers, UART, ADC, SPI, watchdog and interrupts. Stack pointer, External SRAM access and Boot Block setup (Reset and Interrupt Vector locations) can also be set.

This powerful feature gives you instant source code templates and code examples. It also reduces the need to read all the datasheets before you start your development, saving you time and money.



- Supported devices include ATmega8515 and ATmega8535
- Support for all new Timers, ADC features, External RAM access configuration etc.
- Bootloader support, including placing of Reset and Interrupt Vectors
- Output type can be Assembler or C code
- Runs under all Windows operating systems

### Atmel AVR Studio

Atmel's superb development environment, AVR Studio 4, is included on the CD so you do not have to download it. It includes full editor, assembler and simulator for all the AVR devices. It is project based so that you can keep all your files together without any hassle. This is the best microcontroller development environment available from any manufacturer.

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- ATmega168
- ATmega32
- ATmega323

ISP Support only - no board support:

- ATmega64
- ATmega169

ISP support only - board support on STK300:

- ATmega103
- ATmega128

**Order Code:**

**STK200ICE**

**STK200ICEU**

## AVREdit

The AvrEdit is a freeware program developed by Hae-Kwon Hwang. This Windows program is not a compiler itself, but an editor / IDE to easily use the free GNU C-compiler AVRGCC. It features configurable syntax colouring, a simple file browser, a makefile generator and even a small bitmap-to-array editor. This version includes AVR-GCC 3.2 in a complete self-extracting installer.

## Contents

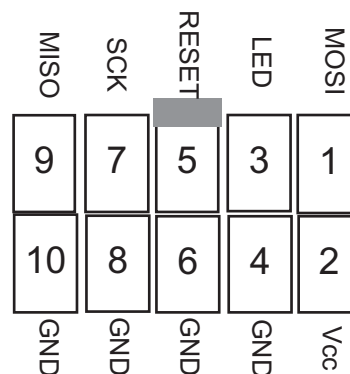
- STK200 Board with AVR device
- NAVRISP Parallel Port Programmer
- Programming lead, LED and Socket leads
- JTAGAVR ICE, leads and adapters plus serial lead (USB adapter on STK200ICEU)
- On CD:
  - Programming software
  - Application Builder
  - User Manual
  - Code Examples
  - Board schematics
  - Device datasheets
  - Atmel AVR Studio3 and 4 (distributed under licence conditions of Atmel Corp.©)
  - AVREdit IDE/Editor (© Hae-Kwon Hwang) with AVRGCC 3.2 C Compiler

## Technical

- Power Supply requirements. The board needs 9-15VDC or 7-12VAC. Connector type is a 2.1mm barrel connector, centre positive. See PSUSTK-UK, PSU135-EU or PSU135-US for suitable PSU (wall transformers)

- Clock. Default is 8MHz but can be replaced by crystals up to 16MHz as crystal is in socket

- Programming Interface (ISP).



- Socket Support

DEVICE	SOCKET
AT90S1200	20D
AT90S2313	20D
AT90S2323	8D
AT90S2343	8D
AT90S2333	28D
AT90S4433	28D
AT90S4414	40D
AT90S8515	40D
AT90S8535	40A

DEVICE	SOCKET
ATmega48	28D
ATmega88	28D
ATmega168	28D
ATmega8	28D
ATmega16	40A
ATmega161	40D
ATmega163	40A
ATmega8535	40A
ATmega8515	40D
ATmega32	40A
ATmega162	40D

DEVICE	SOCKET
ATtiny26	20A
ATtiny2313	20D
ATtiny12	8D
ATtiny13	8D
ATtiny15	8D
ATtiny22	8D

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ISP Support only - no  
board support:

- ATmega64
- ATmega169

ISP support only -  
board support on  
STK300:

- ATmega103
- ATmega128

Order Code:

STK200ICE

STK200ICEU

- Physical
- Dimensions: 130 x 100 mm (5 inches x 4 inches)
- Package weight: 300g (10 oz)

- External memory socket for  
AT29C Flash RAM



## Accessories

Order Code	Description
STK200-RAM	Flash RAM (AT29C256) and Address latch (74HC573)
467200-PM	Data Entry Key Pad (4 x 3)
570910-PM	Intelligent Alphanumeric LCD (16 x 2)
PSU135-US	110V/13.5V Unregulated wall transformer
PSU135-EU	220V/13.5 Unregulated PSU
PSUSTK-UK	220V/15V regulated PSU
EE-02	256 Byte 24C EEPROM

## Related Products

Order Code	Description
NSTK300	Starter Kit for ATmega128 devices. Comes with 64-pin TQFP device mounted on custom header. Ideal for larger projects
PSI-ISP	Serial and parallel port programmer. Faster with serial port option. Better low voltage support
NAVRUSB	USB port Programmer - our best and fastest programmer. Ideal for production and using multiple programmers from 1 PC. DLL available
AVR Devices	We can supply all AVR devices in small or large quantities. Memories and other devices are also available

**Kanda.com**

Embedded Results Ltd  
P.O. Box 200  
Aberystwyth,  
SY23 2WD UK

Tel: +44 (0) 8707 446 807  
Fax: +44 (0) 8707 446 807  
Email: [sales@kanda.com](mailto:sales@kanda.com)  
Web: [www.kanda.com](http://www.kanda.com)



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**STK300ICEU**

# AVR®

## AVR JTAG ICE

### Complete Debugging for AVR Microcontrollers



#### Introduction

Newer AVR devices have a JTAG interface built-in. The JTAGAVR tool uses this JTAG port for On-chip Debugging. This is real time emulation whilst the chip is running in the target system. It can also use the JTAG interface for programming operations.

The JTAGAVR works in conjunction with Atmel's AVR Studio® software (version 4.05 or later). AVR Studio® is a superb integrated development environment with editors, assemblers, support for C compilers, Simulator and support for hardware ICE such as JTAGAVR. So, JTAGAVR acts as a hardware interface between AVR Studio and your target system, which makes it simple to setup and use. It also means that you can debug assembler or high level languages such as C.

The JTAG interface header recommended by Atmel is used by the JTAGAVR. This header is described later. However your target system may not have this interface e.g. STK200, STK300 or STK500, because they use the standard Kanda ISP header layout. Therefore, we have included port adapters in the kit that allow you to plug the JTAGAVR directly onto the port headers on these boards. This means that you can include JTAGAVR in your existing development system without having to mess around with wires and soldering irons - hassle free integration.

The JTAGAVR gives you instant In Circuit Emulation at the lowest possible cost, with the added bonus of device programming using the same hardware. We also supply JTAGAVR with an STK200 or STK300 Kit if you do not already have any development hardware. USB versions are also available.

#### What is On-chip Debugging (OCD)?

The JTAGAVR differs from a traditional In-Circuit Emulator (ICE) because the JTAGAVR uses On-Chip Debugging (OCD). A traditional Emulator is a device built to emulate the behaviour of a single device or a group of devices, whereas the JTAGAVR interfaces to the internal On-Chip Debug system inside the target AVR. This provides an interface and a method for monitoring and controlling code execution in a physical AVR device through the JTAG interface.

This OCD logic can be used to control the execution of code in the device. So while a traditional Emulator emulates device behaviour, the JTAGAVR will take control of the device and execute the code on the actual device. Using the OCD system, exact electrical and timing characteristics are achieved. The JTAGAVR can operate from 3 volt to 5 volt, which enables the JTAGAVR to emulate all AVR devices with the JTAG interface.

●**Simple:**  
Plugs into AVR  
Studio

●**USB or Serial:**  
Serial Port or USB  
versions available

●**Flexible:**  
Uses JTAG  
interface or port head-  
ers on STK200,  
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#### ●**Device Support**

ATmega16  
ATmega162  
ATmega169  
ATmega32  
ATmega323  
ATmega64  
ATmega128  
AT90CAN128

New AVR devices will  
be supported as they  
are released.

Order Codes  
**JTAGAVR**  
**JTAGAVRU**  
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**STK200ICEU**  
**STK300ICE**  
**STK300ICEU**



## Contents

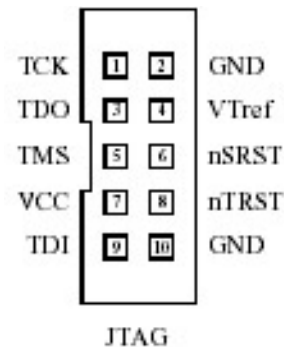
- JTAGAVR tool with JTAG port interface
- JTAGAVR firmware update interface
- STK200/300/500 interface adapters (2)
- Serial lead
- CD with user manual, AVR Studio and device datasheets
- USB Interface - JTAGAVRU only

## Interfaces

### Atmel JTAG Interface

The JTAGAVR tool uses the standard JTAG interface pictured here. This interface is present on some development boards eg STK501.

If your target system has this interface, simply plug in the JTAG tool without any adapters.

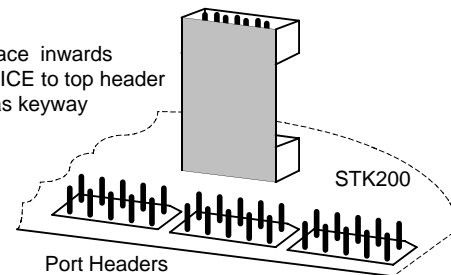


### STK200/STK300 and STK500 Interface

Two interface adapters are supplied to allow the JTAGICE to be connected directly to the port headers on these boards. Different AVR devices have the JTAG port on different device port pins, which is why two interfaces are supplied type A and B. The adapters correctly route the JTAG signals, GND and VCC pins so that you just need to connect the adapter to the correct port header on the STK200, STK300 or STK500 and plug-in the JTAGICE.

#### Adapter:

Box Headers face inwards  
Connect JTAGICE to top header  
Top Header has keyway



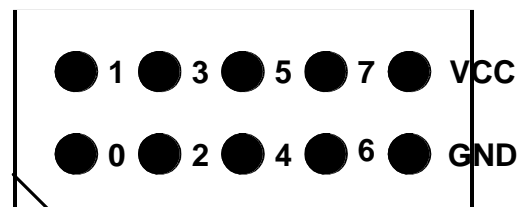
AVR Type1	JTAG Interface	Connection
ATmega128	TDI - PF7	Connect <b>Adapter A</b> to <b>Port F header</b> on STK200/STK300 or STK500. Also called Analog header on STK300.
ATmega64	TDO - PF6	
ATmega169	TMS - PF5	
ATmega165	TCK - PF4	
ATmega325/625		
ATmega3250/6250		

AVR Type2	JTAG Interface	Connection
ATmega32	TDI - PC5	Connect <b>Adapter B</b> to <b>Port C header</b> on STK200/STK300 or STK500.
ATmega323	TDO - PC4	
ATmega16	TMS - PC3	
ATmega16	TCK - PC2	

AVR Type3	JTAG Interface	Connection
ATmega162	TDI - PC7	Connect <b>Adapter A</b> to <b>Port C header</b> on STK200/STK300 or STK500.
	TDO - PC6	
	TMS - PC5	
	TCK - PC4	

Edge of STK200/300/500

Layout of port headers on STK200, STK300 and STK500 is shown in this diagram. The adapter routes the JTAG signals to the correct pin on the AVR device. You just need to connect the right adapter to the JTAGAVR and plug it into the right port header on the board.



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Plugs into AVR Studio

**USB or Serial:**

Serial Port or USB versions available

**Flexible:**

Uses JTAG interface or port headers on STK200, STK300 or STK500

**Easy operation:**

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**Comprehensive:**

Debugging or device programming

**Convenient:**

Compatible with STK200/300/500

**Voltage range:**

3V - 5V

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Use any ISP to update firmware for new devices

**Breakpoints:**

Data and Program Memory breakpoints plus Break on Change of Program Flow

**Supports:**

Assembler and HLL Source Level Debugging

**Device Support**

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**Custom User Interface**

If you want to create your own interface, please note the following points:

●A minimum of 6 wires is required to connect the JTAGAVR to the target board.

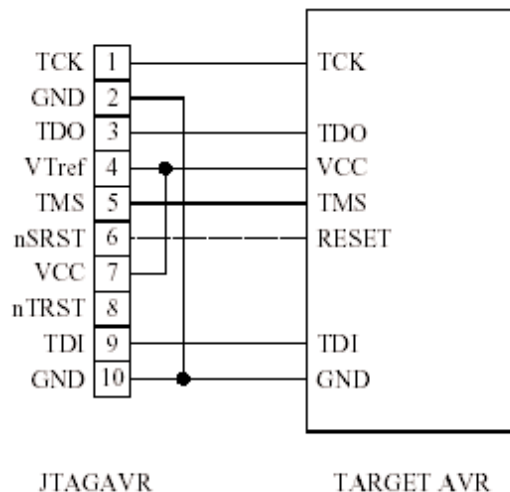
●These signals are TCK, TDO, TDI, TMS, VTref (or VCC) and GND.

●The VCC is connected to VTref on the JTAGAVR board because the JTAGAVR requires a power supply from target board

●nTRST signal is not used for debug or program mode but it is used for upgrading firmware.

●The nSRST is used to control and monitor the target reset line. This is however not necessary for correct emulation. But if the application code sets the JID bit in the MCUCSR, the JTAG Interface will be disabled. To enable the JTAGAVR to reprogram the target AVR, it will need to have control of the Reset pin.

This picture shows the lines that should be connected from the target AVR to the JTAGAVR.

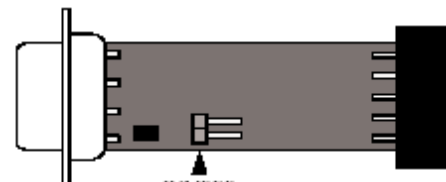
**Connecting to PC**

The JTAGAVR uses a standard RS-232 port for communication with AVR Studio, or a Virtual serial port on the USB version.

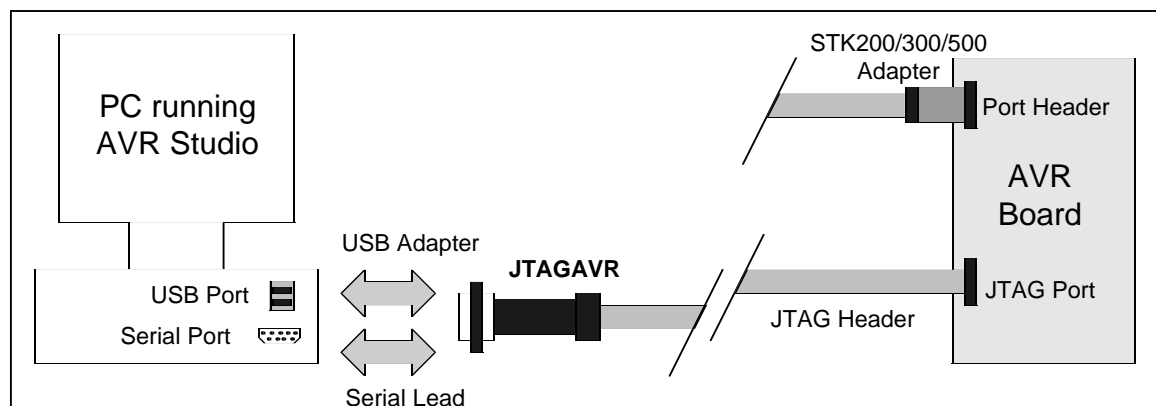
1. Connect the DB9 connector on the JTAGAVR to RS232 (serial) port of computer, using the serial lead supplied, or with the USB version, connect it to the DB9 connector on the USB adapter and plug in to USB port.

2. Plug JTAGAVR cable onto the JTAG header on a target board if available, or use the adapters supplied to connect to the port headers on a STK200/300/500.

3. Ensure that the jumper on the bottom of the JTAGAVR is open as shown. The jumper is only closed when performing firmware updates.



When the connection has been made, apply power to the target board and the POWER LED on the JTAGAVR should light. The ACTIVE LED will light when a communication is made between AVR Studio and the JTAGAVR.





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## Running JTAGAVR

Once the JTAGAVR is connected and powered up, as described above, then run AVR Studio. Open a project, and AVR Studio will search for the JTAGICE.

Note: Disconnect or power down any other AVR Studio compatible tools or Studio may find them first.

If JTAGAVR finds a powered board, it will attempt to read the device ID. If no ID can be read, then check the following:

1. The target AVR is not connected to the JTAGAVR

**Solution:** Verify that the JTAGAVR is correctly connected to the target AVR

2. The JTAG interface fuse is not enabled on the target AVR

**Solution:** Use another interface (e.g. AVRISP) to verify that the JTAG enable fuse is set.

3. The JTAG interface fuse is enabled, but the existing application on the target AVR has set the JTD (JTAG Disable) bit in the MCUCSR register.

**Solution:** Holding the target AVR in Reset will prevent the JTD bit from being set by the application code. If the Reset line on the target AVR is connected to the JTAGAVR, the JTAGAVR can hold the Reset line during the reprogramming as long as the Hold Reset option is selected.

4. JTAG frequency is too high for target frequency.

**Solution:** Choose Debug Menu->JTAG ICE Options and reduce JTAG frequency to one quarter of target board frequency.

When the JTAG ID is read successfully the JTAGAVR will read the lock bit setting. If the lock bits are set, the JTAGAVR will do a chip erase on the target AVR before proceeding.

The JTAGAVR will then automatically enable the OCD(On-Chip Debug) fuse on the target AVR.

Note that the JTAGAVR will also automatically disable the OCD fuse when the debugging session is finished and the project is closed. Based on the JTAG ID from the target AVR, AVR Studio will configure the correct IO view and setting accordingly.

## Breakpoints

### Hardware Breakpoints

Unlike other Atmel AVR emulators, the JTAGAVR has a limited amount of hardware breakpoints. 3 general-purpose (GP) hardware breakpoints are available. In addition there is a special "break on change of program flow" option, which can be enabled.

The 3 GP hardware breakpoints can be used as:

- 3 general-purpose breakpoints
- 2 general-purpose breakpoints and 1 data break point
- 1 general-purpose breakpoints and 2 data breakpoint
- 1 general-purpose breakpoints and 1 masked SRAM breakpoint
- 1 general-purpose breakpoints and 1 masked Flash breakpoint

Break on change of program flow can be enabled or disabled regardless of which other breakpoint options are used. AVR Studio will keep track of which modes are used, and will give a warning if too many breakpoints are used.

\* The JTAG documentation states that 4 GP breakpoints are available. This is correct, but in the JTAGAVR one breakpoint is permanently used for internal JTAGAVR usage. The three other are freely available.

### Software Breakpoints

Note that software breakpoints are not supported in this release (Firmware from AVR Studio version 4.10 Build356).



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## Breakpoints - continued

### Breakpoint Instructions

Some AVR devices support break point instructions. Using break instructions means that the actual instruction is replaced by a break instruction in the Flash memory during debugging. By using break instructions an unlimited number of breakpoint can be used. Since the actual instruction is replaced by a break instruction, the flash page has to be re-programmed when adding or removing a breakpoint. The break instructions are thus slower to use than hardware breakpoints. AVR Studio controls the breakpoints and full instructions are given in our user manual.

## JTAG Programming

In addition to using the JTAGAVR as an On-Chip Debugger, it can also be used as a programmer. The JTAG programming interface is launched from AVR Studio. Activate the menu option Tools -> STK500 to open the programming interface. AVR Studio will search the COM ports for the JTAGAVR. Note that AVR Studio searches through the COM ports in a sequential order, so make sure any other AVR Tools are switched off or disconnected, as AVR studio will look for all supported AVR tools and connect to the first tool it finds. Note that the programming interface also support JTAG Daisy Chain.

Make sure no other device or application has control of the selected COM port, and that there are no active debugging sessions using JTAGAVR.

### Caution:

1. If you disable the JTAG Enable fuse you will not be able to communicate with the target AVR using the JTAGAVR.
2. To ensure correct programming when using the JTAG interface, you must perform a chip erase before programming the Flash or EEPROM.
3. Remember to disable the "Preserve EEPROM" fuse if you intend to reprogram the EEPROM.

## Full Development Kits

The JTAGAVR is also available with the STK200 and STK300 kits - see below for part numbers. With these options, you get a full development kit with:

- JTAGAVR In Circuit Emulator, with adapters
- STK200 or STK300 Board with AVR device (ATmega162 or ATmega128L)
- NAVRISP Parallel Port Programmer
- Programming lead, LED and Socket leads
- On CD:
  - Programming software
  - Application Builder
  - User Manuals
  - Code Examples
  - Board schematics
  - Device datasheets
  - Atmel AVR Studio3 and 4 (distributed under licence conditions of Atmel Corp.©)
  - AVREdit IDE/Editor (© Hae-Kwon Hwang) with AVRGCC 3.2 C Compiler

## Order Codes

Order Codes	Description
<b>JTAGAVR</b>	JTAGAVR Interface plus adapters and serial lead
<b>JTAGAVRU</b>	JTAGAVR Interface plus adapters and USB adapter
<b>STK200ICE</b>	JTAGAVR plus adapters, serial lead, STK200 Board, C Compiler etc.
<b>STK200ICEU</b>	JTAGAVR plus adapters, USB adapter, STK200 Board, C Compiler etc.
<b>STK300ICE</b>	JTAGAVR plus adapters, serial lead, STK300 Board, C Compiler etc.
<b>STK300ICEU</b>	JTAGAVR plus adapters, USB adapter, STK300 Board, C Compiler etc.

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website: [www.kanda.com](http://www.kanda.com) email: [sales@kanda.com](mailto:sales@kanda.com) Phone/Fax: +44(0)8707 446 807

●**Simple:**  
Plugs into AVR  
Studio

●**USB or Serial:**  
Serial Port or USB  
versions available

●**Flexible:**  
Uses JTAG  
interface or port head-  
ers on STK200,  
STK300 or STK500

●**Easy operation:**  
Powered from target

●**Comprehensive:**  
Debugging or device  
programming

●**Convenient:**  
Compatible with  
STK200/300/500

●**Voltage range:**  
3V - 5V

●**Firmware updates:**  
Use any ISP to  
update firmware for  
new devices

●**Breakpoints:**  
Data and Program  
Memory breakpoints  
plus Break on Change  
of Program Flow

●**Supports:**  
Assembler and HLL  
Source Level  
Debugging

●**Device Support**

ATmega16  
ATmega162  
ATmega169  
ATmega32  
ATmega323  
ATmega64  
ATmega128  
AT90CAN128

New AVR devices will  
be supported as they  
are released.

Order Codes  
**JTAGAVR**  
**JTAGAVRU**  
**STK200ICE**  
**STK200ICEU**  
**STK300ICE**  
**STK300ICEU**



## Using JTAGAVR with STK200, STK300, STK500

Connect the JTAGAVR to the PC as described above.

Choose the correct adapter (A or B - marked on front of board) depending on the AVR device selected - see table on page 2

Plug the adapter into the end of the JTAGAVR lead - it can only be inserted the right way round.

Plug the adapter onto the correct port header on the STK board - Port C or Port F (Port F is called Analog header on STK300). Again this depends on the device being used as listed on Page 2.

**STK200ICE - supplied with ATmega162, so use Adapter B and connect to Port C**

**STK300ICE - supplied with ATmega128, so use adapter A on Port F (Analog)**

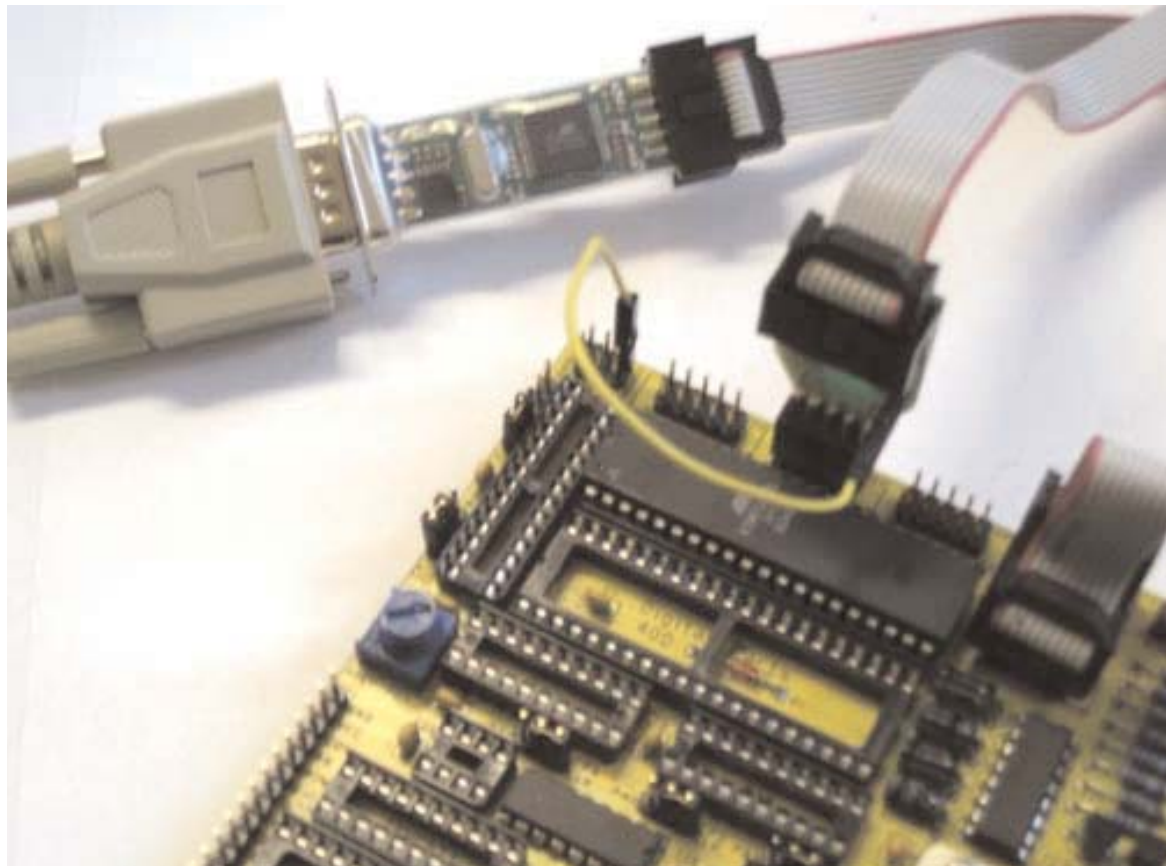
The adapter is connected with solder side out as shown in picture below.

### Reset Lead

A reset lead is supplied to enable JTAGAVR to control Reset Line. This does NOT have to be connected, unless the Device has JTAG Disable Fuse set.

The reset pin on the STK200 is the middle pin on the outside of the 6-way header, marked Reset. Connect the cable supplied from Reset Pin of adapter to this reset pin.

On STK300, Reset is the middle outside pin of MISC header



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